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TITLE / METHOD AND APPARATUS FOR HEATING A ZONE
OF AN ELONGATE TUBULAR ARTICLE

Method and Apparatus for Heating a Zone of an Elongate
Tubular Article

BACKGROUND OF THE INVENTION

[0001]The present invention relates to a method and apparatus for heating a zone of an elongate tubular article, for example a zone of the surface of a pipeline in the course of applying a sleeve or patch on coated pipes, employing a hot gas source, such as a heater device that provides a heated air stream, or when using a flame, such as a torch flame to heat the pipe.

[0002]Heating may, for example, be employed for heating a pipeline weld joint and the adjacent coating in the field to a temperature suitable for subsequent installation of a covering. In particular, the present method and apparatus are especially useful where the temperature to which the line coating must be heated exceeds its melting point, and the covering is to be applied is a heat shrinkable sleeve, tape or patch coated with a hot melt adhesive whose adhesive requires the substrate to be heated to a temperature close to or above the melting point of the substrate. More particularly, the method is especially advantageous when the coating on the pipeline is polypropylene, and the hot melt adhesive on the sleeve, tape or patch requires the substrate to be at least 160°C in order to achieve an acceptable bond.

BRIEF SUMMARY OF THE INVENTION

[0003]In the present invention, a heat resistant, heat transmitting and heat dispersive shroud material is applied on a zone of the surface of the pipeline or other elongate tubular article to be heated, and a hot gas source is applied to the outside of the shroud material to cause heat to be transmitted through the shroud

material to said zone.

[0004]The function of the shroud material is to protect the pipeline coating from direct exposure to the combustion product of the flame, while effectively
5 transferring the heat from the flame to the pipeline coating. In the absence of the shroud material, the extreme temperature of the flame or hot gas has been found to degrade the pipeline coating. For example, if
10 the pipeline coating is polypropylene, it causes the surface to become "waxy" due to degradation of the polymer and/or blooming to the surface of lower molecular weight polymer and additives. Such a surface is very difficult to bond to.

[0005]Further, the shroud material serves to reduce the rate of heat transfer through the pipeline coating to the steel pipe, as compared with the rate of heat transfer that would occur if the hot gas source were played directly on the pipeline coating. Such reduction in the rate of heat transfer may for example be achieved by virtue of the fact that the shroud material may be heat insulative, so that a temperature gradient exists between the outer and the inner sides of the shroud material.
15 Secondly, or alternatively, the shroud material may be heat dispersive, that is to say it disperses hot gases
20 transversely over its outer side when a source of hot gas is played on the outer side of the shroud material.
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[0006]By reducing the rate of heat transfer through the pipeline coating, the advantage may be achieved that, with adhesively bonded thermoplastic coatings, the
30 reduction in heat transfer may reduce or eliminate total melting of the coating and adhesive and consequent dimensional instability of the coating and/or adhesive.

[0007]While the method of the present invention is

particularly advantageous when used in the installation
of field coating over pipelines covered with
thermoplastic coatings, it may be used advantageously for
pipes coated with any material which does not stand up
well upon direct exposure to a flame, and with any field-
applied coating system which requires substrate
temperatures high enough to imperil the integrity of the
pipe coating.

[0008]The shroud material should be heat resistant, so
that it does not melt, burn, distort or decompose when
the hot gases or flame is played on it.

[0009]The shroud material is preferably designed to
transmit heat at an optimum rate to the pipeline coating.
If it is too insulating, the heating rate will be
unacceptably low. If it is too conductive, or if it has
openings that allow the hot gases to pass through, it
will not protect the pipeline coating against
degradation. Examples of suitable materials include non-
burning, continuous pervious woven or non-woven blanket
materials, for example non-metallic woven blanket
materials, metallic mesh materials, and heat conductive
sheet materials for example metal strip material which
may, for example, be backed with an insulative liner,
which may also serve as a release coating, for example of
polytetrafluoroethylene (TEFLON trade-mark). One skilled
in the art of pipeline coatings can readily determine by
routine experimentation whether a given material is
suitable for use as a shroud material in accordance with
the invention.

[0010]Desirably, the shroud material is flexible, so that
it can be wrapped around or will conform closely to the
curvature of the pipeline or other tubular article. One
particularly preferred material is woven glass fibre mat,
for example two thicknesses of the woven glass fibre

material sold by Amatek Inc., Wilmington, Delaware, under
the trade-mark SILTEMP P4CSR.

[0011] In one particularly preferred form of the present
invention, the shroud material is used together with heat
5 shield structures comprising two heat resistant flanges
spaced apart, for example axially of the tubular article,
and having the covering material disposed between the
flanges, so that the heat is trapped and is more
efficiently channelled to the exposed surface of the
10 shroud material.

[0012] In the preferred form, for heating a pipeline weld
joint and the adjacent coating for subsequent
installation of a covering, two heat shield structures
are used. At each end of the weld joint, shroud material
15 is wrapped, the shroud material being wider than the
width of the region of the pipeline coating to be heated.
A heat shield structure providing an inner and an outer
flange is installed over the pipeline coating adjoining
the uncoated steel weld joint at each end of the weld
20 joint. Heating, preferably by direct flame, is then
trained on the region between the two inner most flanges
to heat the uncoated steel to the temperature necessary
to achieve a good bond to the adhesive on the field joint
covering. Heating is then applied, preferably using
25 direct flame, to the regions between the inner and outer
flanges, to heat the pipeline coating to a temperature
above the minimum at which a bond can be established with
the adhesive on the field joint covering. The flame is
trains on the non-burning shroud material and the heat
30 penetrates through it to the underlying coating.

[0013] The heat shields are then removed, and the field
joint covering is installed before the weld joint and the
adjacent coating can cool to a temperature below which a
bond to the field joint covering can be achieved.

[0014] In the preferred form, each heat shield structure consists of an inner split metal flange and an outer split metal flange that are connected together to create a confined space somewhat wider than the width of the portion of the pipeline coating to be heated. The outer flange preferably has a cylindrical axially outward extension to protect the pipeline coating, to assist in securing the shroud material, and to assist in achieving and maintaining alignment with the pipe.

10 BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0015] The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings.

15 [0016] Figure 1 is a partially schematic side view, partially in section, showing a pipe joint together with one form of apparatus in accordance with the invention.

[0017] Figure 2 is a fragmentary plan view of a shroud material employed in the method and apparatus of the present invention.

20 [0018] Figure 3 is a longitudinal cross section through the joined ends of the shroud material of Fig. 2, taken on the line 3-3 in Fig. 5.

25 [0019] Figure 4 is a partially schematic perspective view showing a method of joining the ends of the shroud material.

[0020] Figure 5 is a partially schematic perspective view showing the pipe joint together with an apparatus of the invention.

[0021] Figure 6 is a partially schematic cross section

showing a further form of apparatus in accordance with the invention.

[0022]Figure 7 is a plan view of the apparatus of Fig. 6.

DETAILED DESCRIPTION OF THE INVENTION

5 [0023]Referring to the drawings, Fig. 1 shows by way of example pipe sections 11 and 12 welded together at a weld joint 13.

10 [0024]Outwardly from the joint 13, each pipe section 11 and 12 has a polyolefin, for example polypropylene, pipe coating 14 and 16 thereon.

15 [0025]It may be desired to install a heat shrinkable sleeve covering the portions of metal of the pipe sections 11 and 12 adjacent the weld joint 13 that are free of the coatings 14 and 16, such sleeve being connected to the coatings 14 and 16. Such heat shrinkable sleeve may be, for example, as described and shown in applicant's co-pending patent application serial no. PCT/CA01/00710 published under no. WO 01/87584 filed May 18, 2001, the disclosures of which are incorporated herein by reference. Such sleeve may comprise heat activatable components that require that the metal of the pipe adjacent the weld joint 13 and the coatings 14 and 16 be raised to a range of activation temperatures in order to allow successful installation.

25 [0026]In one preferred embodiment shown in the drawings, the ends of the coatings 14 and 16, adjacent the weld joint, have a shroud material 17 wrapped around their periphery. The wrapping of the shroud material 17 corresponds in position to and is slightly wider than the width of the regions of the pipeline coatings 14 and 16 onto which the ends of the above-mentioned heat shrink

sleeve are to be shrunk.

[0027] As seen in Fig. 2, each shroud material piece 17 comprises a flexible generally rectangular band 18 provided with end fittings 19 and 21 which cooperate to allow the ends of the bands to be joined together.

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[0028] In the most preferred form, each band 18 comprises two thicknesses of SILTEMP P4CSR woven glass fibre mat.

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[0029] Each end fitting 19 and 21 comprises a length of metal channel, for example an aluminum extrusion, into which an end of the mat 18 is introduced, and the edges of the channel deformed inwardly from its original configuration in order to secure the mat 18. One channel 19 may be provided with a pair of upstanding lugs, while the other channel 21 is provided with lugs having pivoting clips 24. The length of the shroud material 17 is such that it fits snugly around the perimeter of the coating 14 or 16 when the ends are joined together. As seen in Figs. 3 and 4, the joined together end 19 and 21 can be connected by flipping the clips 24 to engage over the lugs 23.

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[0030] After the lengths of shroud material have been wrapped around the coatings 14 and 16, and the end fittings have been connected together, a pair of heat shield structures 26 and 27 are applied over the shroud material, as seen in Fig. 1.

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[0031] Each shroud structure 26 and 27 comprises in the preferred form a pair of flanges, namely, an axially inner and axially outer radially extending annular flange 28 and 29, respectively. The flanges 28 and 29 are spaced apart by spacer rods 31 a distance corresponding to the length of the coating 14 or 16 that it is desired to heat.

[0032] Preferably, each axially outer flange 29 has connected to it an outwardly extending cylindrical extension 32.

5 [0033] In the preferred form, each heat shield structure, as best seen in Fig. 5 comprises two semi-cylindrical portions 26a and 26b and 27a and 27b, these portions being hinged together at hinges 33 on one side, and, on an opposite side, being provided with latches 34 that allow the portions to be latched together in a closed position.
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[0034] The heat shield structure may be of any heat resistant material for example metal such as steel.

15 [0035] In the preferred form, as seen in Fig. 1, the opening of the inner flange 28 engages on the outer side of the coating 14 or 16, while the inner opening of the outer flange 29 and the inner periphery of the extension 32 clamps tightly on the shroud material 17 in the closed position.

20 [0036] In the course of installation of a sleeve, the steel pipe between the two inner flanges is heated by application of hot gases, preferably from a propane hand torch 36 until a desired temperature is attained. Other heating devices may of course be employed, for example heating devices providing a stream of hot air.

25 [0037] Similarly, the pipeline coatings 14 and 16 in the zone between each pair of flanges 28 and 29 is heated, again preferably with propane torches 37 until the pipeline coating attains a desired temperature.

30 [0038] The flange assemblies are then opened and the shroud materials 17 removed and immediately thereafter a heat shrink sleeve is applied over the heated portion and

is shrunk tightly around the joint, again preferably by using heat applied directly on the exterior of the sleeve, for example with propane torches.

5 [0039] During the heating steps, the temperatures of the bare metal and of the coating can be measured using conventional temperature measuring devices, for example thermocouples applied to the surfaces of the metal and to the coatings 14 and 16, respectively.

10 [0040] An example of a procedure using the above apparatus and method described in detail with reference to Figs. 1 to 5 will now be given.

Example

15 [0041] A pipeline had a coating of 2.5 mm thick 3-layer polypropylene, and the bare steel weld joint was 100 mm wide. The procedure was as follows:

[0042] The coating adjacent to both ends of a bare steel weld joint was tightly wrapped with a double wrap of 100 mm wide Siltemp P4CSR.

20 [0043] A heat shield structure as shown in Figs. 1 to 5 of the accompanying drawings was clamped over each Siltemp blanket.

[0044] The steel pipe between the two inner flanges was heated with propane hand held torches to approximately 200°C.

25 [0045] The propane hand torches were then directed between the inner and outer flanges on either end, directing the flame directly at the blanket, until the pipeline coating temperature reached 150 to 160°C.

[0046]The heat shield structures and blankets were removed and immediately thereafter a heat shrink sleeve consisting of a crosslinked polypropylene-based heat shrinkable backing coated inside with a polypropylene based hot melt adhesive was placed over the heated area.

[0047]The heat shrink sleeve was shrunk tightly around the joint using the propane torches.

[0048]Upon removal of the blanket after heating, it was apparent that the surface of the polypropylene was not waxy.

[0049]After completion of the procedure and cooling to ambient temperature, excellent adhesion was observed between the sleeve adhesive and the pipeline coating, and between the sleeve adhesive and the steel.

[0050]While the above description has referred to application of a sleeve to the exterior of a pipeline coating, it will be appreciated that a similar blanket structure and heat shield structure may be used in the application of a patch to effect a repair to a holiday in a pipeline coating.

[0051]For example Figs. 6 and 7 show a heat shield structure comprising inner and outer endless, for example cylindrical, heat resistant flanges 41 and 42, respectively, extending away from and preferably substantially normal to the surface of the pipe 43. Outer cylinder 42 has a transversely outward extension 44. The radially inner surfaces of elements 41, 42 and 44 may be saddle-shaped to conform to the curvature of pipe 43. Shroud material 46 extends between flanges 41 and 42 and preferably beneath extension 44. The heat shield structure and shroud material may be formed from

materials similar to those employed for the corresponding elements in the apparatus described above with reference to Figs. 1 to 5. In use, an appropriately sized circle of damaged coating 47 is removed down to bare metal 43. The
5 heat shield structure and shroud material is applied as shown in Figs. 6 and 7. The bare metal 43 is heated through the inner cylindrical shield 41 and the adjacent coating 47 by training a flame into the annular section between cylinders 41 and 42. Once the desired
10 temperatures are attained, the heat shield and shroud material are removed and a patch of heat activatable repair material is applied.